and an active material mechanism disposed in operable communication with the cover. The active material mechanism, which is configured to enable the cover to be deployed and retracted with a vehicle window, can comprise a grip configured to hold the cover to the window, and an active material element attached to the grip. The active material element, when activated, causes the grip to engage the cover and window. Alternatively, or in addition, the active material mechanism can be in operable communication with a flywheel and be configured to provide angular momentum to the flywheel to deploy the cover.

[0028] In another embodiment, a cover system comprises: a scroll comprising an active material mechanism and a flexible cover configured to inhibit the passage of light, sound, heat, moisture, etc. through the cover and configured to cover a desired area when deployed. The active material mechanism, when activated, deploys the cover from the scroll across at least a portion of the desired area.

[0029] The cover system can comprise: a cover configured to be disposed near a glazing area and an active material mechanism disposed in operable communication with the cover. The active material mechanism, which is configured to enable the cover to be deployed and retracted with a vehicle glazing area, comprises a pin configured to hold the cover to the glazing area and an active material element attached to the pin.

[0030] A vehicle can comprise a cover system. The cover system can comprise: elements that are configured to slide in two slots in walls of the vehicle and a cover located between the slots and in operational communication with the rods. The elements are held in the slots by a spring located between the elements. The cover is configured to deploy and retract across an area in the vehicle.

[0031] In still another embodiment, the cover system can comprise: an active material actuator assembly comprising a shaft with an extension located concentric with a cylindrical housing, and a cover in operational communication with the active material actuator assembly. The active material components can be connected to the extension. The active material actuator assembly is configured to deploy and retract the cover. Alternatively, and/or in addition, the cover system can comprise: a cover and an active material component in operable communication with an input shaft, wherein the input shaft is in operable communication with an output shaft, and the output shaft is configured to deploy and retract the cover.

[0032] In another embodiment, the cover system comprises: a cover and a ratchet mechanism comprising an active material component. The ratchet mechanism is configured to perform at least one action selected from the group consisting of lift a dead weight, stretch a linear spring, wind-up a torsional spring, and combinations comprising at least one of the foregoing actions. The ratchet mechanism is configured such that once an action is performed, the ratchet mechanism can be releasably latched. The release of the latch can allow full stroke in a single action.

[0033] Since most shape memory materials (an important class of active materials) are capable of providing only limited displacement, their ability to achieve large stroke or rotation has been enhanced. In particular, the active material is able to provide a large stroke with a low actuation force using displacement multiplier mechanism(s), e.g., in which force is traded for stroke. Active materials (AM) include those compositions that can exhibit variously a change in stiffness properties, shear strength, shape and/or dimensions in response to an activation signal, which can be an electrical, magnetic, thermal or a like field depending on the different types of active materials. Preferred active materials include but are not limited to the class of shape memory materials, and combinations thereof. Shape memory materials refer to materials or compositions that have the ability to remember their original shape, which can subsequently be recalled by applying or removing an external stimulus (i.e., an activation signal). As such, deformation of the shape memory material from the original shape can be a temporary condition.

[0034] A number of exemplary embodiments of active material actuator assemblies are described herein. The active material actuator assemblies all utilize active material components. Exemplary active materials (AM) include: shape memory alloys ("SMAs"; e.g., thermally and stress activated shape memory alloys and magnetic shape memory alloys (MSMA)), electroactive polymers (EAPs) such as dielectric elastomers, ionic polymer metal composites (IPMC), piezoelectric materials (e.g., polymers, ceramics), shape memory polymers (SMPs), shape memory ceramics (SMCs), baroplastics, magnetorheological (MR) materials (e.g., fluids and elastomers), electrorheological (ER) materials (e.g., fluids, and elastomers), composites of the foregoing active materials with non-active materials, and combinations comprising at least one of the foregoing active materials. For convenience and by way of example, reference herein will be made to shape memory materials such as shape memory alloys and shape memory polymers. The shape memory ceramics, baroplastics, and the like, can be employed in a similar manner. For example, with baroplastic materials, a pressure induced mixing of nanophase domains of high and low glass transition temperature (Tg) components effects the shape change. Baroplastics can be processed at relatively low temperatures repeatedly without degradation. SMCs are similar to SMAs but can tolerate much higher operating temperatures than can other shape-memory materials. An example of an SMC is a piezoelectric material.

[0035] The ability of shape memory materials to return to their original shape upon the application (or for some materials removal) of external stimuli has led to their use in actuators to apply force resulting in desired motion. Smart material actuators offer the potential for a reduction in actuator size, weight, volume, cost, noise and an increase in robustness in comparison with traditional electromechanical and electrohydraulic means of actuation. However, most shape memory materials are capable of providing only limited displacement, limiting their use in applications requiring a large displacement, whether linear or rotational. Ferromagnetic SMA's, for example, exhibit rapid dimensional changes of up to several percent in response to (and proportional to the strength of) an applied magnetic field. However, these changes are one-way changes wherein either a biasing force or a field reversal is applied to return the ferromagnetic SMA to its starting configuration.

[0036] Shape memory alloys are alloy compositions with at least two different temperature-dependent phases or polarity. The most commonly utilized of these phases are the so-called martensite and austenite phases. In the following discussion, the martensite phase generally refers to the more deformable, lower temperature phase whereas the austenite phase generally refers to the more rigid, higher temperature phase. When the shape memory alloy is in the martensite phase and is heated, it begins to change into the austenite phase. The temperature at which this phenomenon starts is often referred